

## \* NOTICES \*

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the water resistance improver for ink jet recording sheets, and an ink jet recording sheet. In more detail, it mixes to a pulp fiber, and paper is milled as a slurry, or a regular paper and coated paper are impregnated or coated by this invention.

Therefore, it is related with the ink jet recording sheet which coats the water resistance improver for ink jet recording sheets and this water resistance improver which can improve water resisting properties recorded on a record paper, such as a picture and a character, and can decrease an ink blot.

[0002]

[Description of the Prior Art]The printer of an inkjet method is a printer which injects ink in the shape of a jet, and prints it from a nozzle. Printing of ink jet recording is quiet, there are no processes, such as development fixing, a recorder can be easy, a regular paper and coated paper can be used, and, moreover, colorization has the feature that it is easy and record of a picture or a character figure can be performed freely.

Rapid growth is seen today and the possibilities attract attention.

However, since problems, like a color oozes by adhesion of the water after record arise when a regular paper is used as an ink jet recording sheet, generally a water resistance improver is used. As a water resistance improver, although cationic resin, such as a dicyandiamide condensate, polyamine, and polyethyleneimine, is proposed, for example, Problems, such as waterproof shortage, discoloration of a color tone, yellowing of a blank part, and an ink blot, have arisen, and various trials are made in order to solve many of these problems. For example, the ink jet recording sheet which contains at least the cationic resin produced by

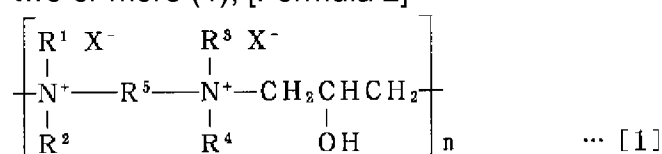
making secondary amine and epihalohydrin react in a record paper surface is proposed by JP,6-92012,A. However, since this object for ink jet recording sheets, in addition, also runs short of a water resisting property and ink blot tightness, there is neither discoloration of a color tone nor yellowing of blank parts, a water resisting property is good and the water resistance improver for ink jet recording sheets and an ink jet recording sheet without an ink blot are called for.

[0003]

[Problem(s) to be Solved by the Invention] This invention improves water resisting properties recorded on a record paper by coating a regular paper and coated paper, such as a picture and a character, And it is made for the purpose of providing the water resistance improver for ink jet recording sheets and ink jet recording sheet which can decrease in number an ink blot.

[0004]

[Means for Solving the Problem] This invention persons can get cationic resin with a large molecular weight easily by the reaction of an amine compound and epihalohydrin which have two or more amino groups, as a result of repeating research wholeheartedly that the above-mentioned technical problem should be solved, The water resisting property of printing recorded with an ink jet printer is good, and finds out not producing an ink blot, either, and a record paper which coated this cationic resin came to complete this invention based on this knowledge. Namely, a water resistance improver for ink jet recording sheets, wherein this invention contains cationic resin which has the structure expressed with a general formula [1] produced by reacting an amine compound and epihalohydrin which have an amino group of two or more (1), [Formula 2]



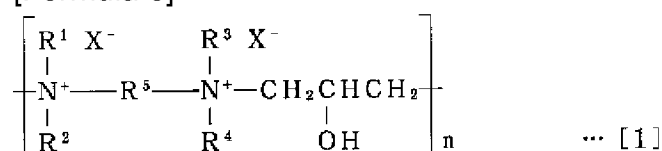
however, the inside of a formula,  $\text{R}^1$ ,  $\text{R}^2$ ,  $\text{R}^3$ , and  $\text{R}^4$  -- hydrogen. Are an alkyl group or benzyl of the carbon numbers 1-4, and  $\text{R}^1$ ,  $\text{R}^2$ ,  $\text{R}^3$  and  $\text{R}^4$  may be the same, or may differ, and  $\text{R}^5$  An alkylene group of the carbon numbers 1-6, They are a phenylene group or a  $[\text{R}^6\text{-N}(\text{R}^8)\text{-R}^7]$  m-basis,  $\text{R}^6$  and  $\text{R}^7$  are alkylene groups or phenylene groups of the carbon numbers 1-4,  $\text{R}^6$  and  $\text{R}^7$  may be the same, or may differ, and  $\text{R}^8$  Hydrogen, It is an alkyl group or benzyl of the carbon numbers 1-4, and m is 1-4,  $\text{X}^-$  is halogen ion and n is 3-300. An amine compound which it has two or more amino groups (2) Ethylenediamine, Diethylenetriamine, triethylenetetramine, tetraethylenepentamine, a water resistance improver for ink jet recording sheets given in \*\* (1) paragraph which is propylenediamine, N,N,N',N'-

tetramethylethylenediamine, or N,N,N',N'-tetramethyl propylenediamine -- and, (3) Provide an ink jet recording sheet which coats a \*\* (1) paragraph or a water resistance improver for ink jet recording sheets given in \*\* (2) paragraph, and is characterized by things.

[0005]

[Embodiment of the Invention]The water resistance improver for ink jet recording sheets of this invention contains the cationic resin which has the structure expressed with the general formula [1] produced by reacting the amine compound and epihalohydrin which have two or more amino groups.

[Formula 3]



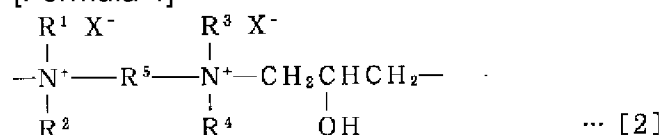
In the general formula [1],  $\text{R}^1$ ,  $\text{R}^2$ ,  $\text{R}^3$ , and  $\text{R}^4$  are the alkyl groups or benzyls of hydrogen and the carbon numbers 1-4, and  $\text{R}^1$ ,  $\text{R}^2$ ,  $\text{R}^3$ , and  $\text{R}^4$  may be the same, or may differ from each other.  $\text{R}^5$  is an alkylene group of the carbon numbers 1-6, a phenylene group, or a  $-\text{[R}^6\text{-N(R}^8\text{)-R}^7\text{]}_m$ -basis,  $\text{R}^6$  and  $\text{R}^7$  are the alkylene groups or phenylene groups of the carbon numbers 1-4,  $\text{R}^6$  and  $\text{R}^7$  may be the same, or it may differ,  $\text{R}^8$  is the alkyl group or benzyl of hydrogen and the carbon numbers 1-4, m is 1-4,  $\text{X}^-$  is halogen ion, and n is 3-300.

[0006]In this invention, a monoalkylamino group, a dialkylamino group, a monoaralkyl amino group, a diaralkylamino group, etc. by which hydrogen other than a  $-\text{NH}_2$  group was replaced by an alkyl group or aralkyl group are contained in an amino group of an amine compound which has two or more amino groups. As an amine compound which has two or more amino groups used for this invention, For example, ethylenediamine, diethylenetriamine, triethylenetetramine, Tetraethylenepentamine, propylenediamine, dipropylenetriamine, A tetramethylenediamine, hexamethylenediamine, N,N,N',N'-tetramethyl methylenediamine, N,N,N',N'-tetraethyl methylenediamine, N,N,N',N'-tetrabenzylmethylenediamine, N,N-dimethylethylenediamine, N,N'-dimethylethylenediamine, N,N,N',N'-tetramethylethylenediamine, N,N,N',N'-tetraethyl ethylenediamine, N,N,N',N'-tetrapropylethylenediamine, N,N,N',N'-tetrabutyl ethylenediamine, N,N,N',N'-tetrabenzylethylenediamine, N,N,N',N'-tetramethyl propylenediamine, N,N,N',N'-tetraethyl propylenediamine, N,N,N',N'-tetrapropylpropylenediamine, N,N,N',N'-tetrabutyl propylenediamine, N,N,N',N'-tetrabenzylpropylenediamine, N,N,N',N'-tetramethyl butylenediamine, N,N,N',N'-tetraethyl butylenediamine, N,N,N',N'-tetrapropylbutylenediamine, N,N,N',N'-tetrabutyl butylenediamine, N,N,N',N'-tetrabenzylbutylenediamine, a N,N,N',N'-

tetramethyl phenylenediamine, A N,N,N',N'-tetraethyl phenylenediamine, a N,N,N',N'-tetrapropylphenylenediamine, A N,N,N',N'-tetrabutyl phenylenediamine, a N,N,N',N'-tetrabenzylphenylenediamine, N,N,N',N'-tetramethyl 4-azaheptane 1,7-diamine, N,N,N',N'-tetramethyl 4-aza-4-methylheptane 1,7-diamine, N,N,N',N'-tetramethyl 4-aza-4-ethylheptane-1,7-diamine, N,N,N',N'-tetramethyl 4-aza-4-propylheptane-1,7-diamine, N,N,N',N'-tetramethyl 4-aza-4-butylheptane-1,7-diamine, N,N,N',N'-tetramethyl 4-aza-4-benzylpentane-1,7-diamine, N,N,N',N'-tetramethyl 5-azanonane-1,9-diamine, N,N,N',N'-tetramethyl 5-aza-5-methylnonane-1,9-diamine, N,N,N',N'-tetramethyl 5-aza-5-ethylnonane-1,9-diamine, N,N,N',N'-tetramethyl 5-aza-5-propylnonane-1,9-diamine, N,N,N',N'-tetramethyl 5-aza-5-butylnonane-1,9-diamine, N,N,N',N'-tetramethyl 5-aza-5-benzylnonane-1,9-diamine, N,N,N',N'-tetramethyl 3,6-diaza octane-1,8-diamine, N,N,N',N'-tetramethyl 3,6-diaza-3,6-dimethyloctane-1,8-diamine, N,N,N',N'-tetramethyl 3,6-diaza-3,6-diethyloctane-1,8-diamine, N,N,N',N'-tetramethyl 3,6-diaza-3,6-dipropyloctane-1,8-diamine, N,N,N',N'-tetramethyl 3,6-diaza-3,6-dibutyloctane-1,8-diamine, N,N,N',N'-tetramethyl 3,6-diaza-3,6-dibenzylloctane-1,8-diamine, N,N,N',N'-tetramethyl 3,6,9 - doria -- ZAUN decane-1,11-diamine. N,N,N',N'-tetramethyl 3,6,9-Tori aza-3,6,9-trimethyl undecane-1,11-diamine, N,N,N',N'-tetramethyl 3,6,9-Tori aza-3,6,9-triethylundecane-1,11-diamine, N,N,N',N'-tetramethyl 3,6,9-Tori aza-3,6,9-TORIPURO pill undecane-1,11-diamine, N,N,N',N'-tetramethyl 3,6,9-Tori aza-3,6,9-tributylundecane-1,11-diamine, N,N,N',N'-tetramethyl 3,6,9-Tori aza-3,6,9-tribenzyl undecane-1,11-diamine, etc. can be mentioned. One sort can be independently used for an amine compound which has these two or more amino groups, or can also be used for it combining two or more sorts. In these, ethylenediamine, diethylenetriamine, triethylenetetramine, Tetraethylenepentamine, propylenediamine, N,N,N',N'-tetramethylethylenediamine, and N,N,N',N'-tetramethyl propylenediamine can be used conveniently.

[0007] There is no restriction in particular in epihalohydrin used for this invention, for example, epichlorohydrin, epibromohydrin, EPIYODO hydrin, etc. can be mentioned. One sort can be independently used for these epihalohydrin, or can also be used for it combining two or more sorts. In these, epichlorohydrin can be used especially conveniently. In cationic resin used for this invention, it is a general formula [2].

[Formula 4]



It comes out and repetition number n of the structure expressed is 3-300. There is a possibility that a waterproof improved effect may not fully be revealed in repetition number n being two or less. When repetition number n exceeds 300, viscosity becomes high too much and there is a possibility that workability, such as coating, may fall. In the cationic resin used for this

invention, there is no restriction in particular in the structure of an end group, for example, amine structure, oxirane ring structure, hydroxymethyl, or a halomethyl group can be made into an end group. The both-ends group of resin may be the same, or may differ. When an end group is an amino group, an imino group, or tertiary amine structure, a salt can be formed with inorganic acid or organic acid, or tertiary amine structure can be formed into 4 class by alkyl halide, aralkyl halide, dialkyl sulfuric acid, alkylene oxide, etc. As inorganic acid, chloride, sulfuric acid, nitric acid, phosphoric acid, etc. can be mentioned, for example. As organic acid, formic acid, acetic acid, lactic acid, malic acid, citrate, etc. can be mentioned, for example. As alkyl halide, for example A methyl chloride, a methyl bromide, a methyl iodide, An ethyl chloride, an ethyl bromide, ethyl iodide, a propyl chloride, propyl bromide, propyl iodide, an isopropyl chloride, isopropyl bromide, an isopropyl iodide, a butyl chloride, a n-butyl bromide, iodination butyl, etc. can be mentioned. As aralkyl halide, a benzyl chloride, p-chlorobenzyl chloride, etc. can be mentioned, for example. As dialkyl sulfuric acid, a dimethyl sulfate, a diethyl sulfate, etc. can be mentioned, for example. As alkylene oxide etc., ethyleneoxide, propylene oxide, butylene oxide, styrene oxide, epichlorohydrin, etc. can be mentioned, for example.

[0008]There is no restriction in particular in a manufacturing method of cationic resin used for this invention. For example, the whole quantity of an amine compound and epihalohydrin which has two or more amino groups can be taught to a reactor, and addition condensation can be carried out, Or after reacting some amine compounds and a part of epihalohydrin which have two or more amino groups, epihalohydrin of an amine compound which has two or more residual amino groups, and the emainder can be added, and a reaction can also be continued. As for quantity of an amine compound which has two or more amino groups added to a reactor, and epihalohydrin, it is preferred that it is the equivalent mostly. A reaction of an amine compound and epihalohydrin which have two or more amino groups can be performed by the ability to add water or an organic solvent if needed, and can control reaction velocity and viscosity of the system of reaction. As an organic solvent added to the system of reaction, for example Acetone, methyl ethyl ketone, Nitrogen system solvents, such as alcohol, such as ketone, such as methyl isobutyl ketone and diisobutyl ketone, methyl alcohol, ethyl alcohol, and isopropyl alcohol, N.N-dimethylformamide, and N-methyl pyrrolidone, dimethyl sulfoxide, etc. can be mentioned. An organic solvent added to the system of reaction is removable by distillation or other means after ending reaction. There is no restriction in particular in conditions which react epihalohydrin to an amine compound which has two or more amino groups, for example, it can react in 50-90 °C for 1 to 8 hours. Although there is no restriction in particular in a molecular weight of cationic resin used for this invention, it is preferred that viscosity measured in 30 °C about solution using a Brookfield viscometer 20% of the weight is 50 - 500 mPa-s, and it is more preferred that it is 80 - 400 mPa-s. There is a possibility that a

waterproof improved effect may not fully be revealed in viscosity measured in 30 °C about solution 20% of the weight being less than 50 mPa-s. When viscosity measured at 30 °C about solution 20% of the weight exceeds 500 mPa-s, viscosity becomes high too much and there is a possibility that workability, such as coating, may fall.

[0009]Cationic resin which has the structure which restriction in particular does not have in a gestalt of a water resistance improver for ink jet recording sheets of this invention, for example, is expressed with a general formula [1] can be made into a gestalt dissolved in a drainage system medium. It can be considered as a medium etc. which restriction in particular does not have in a drainage system medium to be used, for example, added a polar organic solvent in water. As polar solvents to add, for example Methyl alcohol, ethyl alcohol, Propyl alcohol, isopropyl alcohol, n-butyl alcohol, sec-butyl alcohol, t-butyl alcohol, pentyl alcohol, Hexyl alcohol, heptyl alcohol, octyl alcohol, nonyl alcohol, Alcohol, such as decyl alcohol, undecyl alcohol, and dodecyl alcohol, Phenols, such as phenol and cresol, 3-methyl-3-methoxybutanol, 3-methyl-3-methoxy butyl acetate, ethylene glycol monomethyl ether, Ethylene glycol monoethyl ether, ethylene glycol monobutyl ether, Ethylene glycol ethyl ether acetate, diethylene glycol monomethyl ether, Diethylene glycol monoethyl ether, diethylene-glycol monobutyl ether, Diethylene-glycol monohexyl ether, diethylene-glycol dibutyl ether, dipropylene glycol monoethyl ether, dipropyleneglycol monopropyl ether, dipropyleneglycol monobutyl ether, Glycols, such as glycol ether, such as tripropylene glycol monomethyl ether, ethylene glycol, propylene glycol, 1,3-butanediol, hexylene glycol, a diethylene glycol, and dipropylene glycol, etc. can be mentioned. By making a drainage system medium contain a polar organic solvent, the stability of a water resistance improver for ink jet recording sheets can be improved.

[0010]A publicly known binder, an inorganic pigment, an organic color, etc. can be blended with a water resistance improver for ink jet recording sheets of this invention if needed. As a binder, an oxidized starch, polyvinyl alcohol, etc. can be mentioned, for example. As an inorganic pigment, for example Precipitated calcium carbonate, heavy calcium carbonate, Kaolin (clay), talc, calcium sulfate, barium sulfate, titanium oxide, a zinc oxide, sulfate of zinc, zinc carbonate, a satin white, aluminum silicate, diatomite, a calcium silicate, synthetic silica, aluminium hydroxide, alumina, lithopone, etc. can be mentioned. As an organic color, a styrene system plastic pigment, an acrylic plastic pigment, urea resin paints, etc. can be mentioned, for example. As opposed to pulp which restriction in particular does not have in the directions for a water resistance improver for ink jet recording sheets of this invention, for example, ended refining in a mixed chest at the time of preparation of pulp, Paper making of the water resistance improver for ink jet recording sheets can be added and carried out with a loading material, medicine, a color, etc. Although a pulp fiber to be used makes a subject wood pulp usually used, otherwise, it can also use together fibrous material, such as a synthetic

pulp, a synthetic fiber, and glass fiber. After preparing a treatment bath containing a water resistance improver for ink jet recording sheets of this invention and impregnating with a regular paper or coated paper, excessive impregnating liquid of a rear surface part of a regular paper or coated paper can be removed by size press etc., and it can dry. A regular paper and coated paper can also be coated with a water resistance improver for ink jet recording sheets of this invention. A method of coating a water resistance improver for ink jet recording sheets in these methods, Since process control is easy, can respond also to limited production with a wide variety, cationic resin is made to exist only in a layer part of paper and it can utilize effectively, it can carry out suitably especially. When coating a water resistance improver for ink jet recording sheets of this invention, as for the coating amount, it is preferred that it is 0.1-10.0g/m<sup>2</sup> as cationic resin, and it is more preferred that it is 0.2-5.0g/m<sup>2</sup>. There is no restriction in particular in a method of coating a water resistance improver for ink jet recording sheets of this invention, For example, a regular paper and coated paper can be coated by air knife coating machine, roll coater, braid coating machine, bar coating machine, brush coating machine, CHAMPU REXX coating machine, a photogravure coating machine, etc., and it can dry.

[0011]When using a water resistance improver for ink jet recording sheets of this invention, dyeing dye mordant, a defoaming agent, a dispersing agent, a thickener, colorant, a spray for preventing static electricity, an antiseptic, water soluble resin, adhesives, etc. can be used together. As dyeing dye mordant, a dicyandiamide condensate, polyamine, polyethyleneimine, etc. can be mentioned, for example. As water soluble resin and adhesives, for example An oxidized starch, etherification starch, Cellulosics, such as carboxymethyl cellulose and hydroxyethyl cellulose, Casein, gelatin, soybean protein, polyvinyl alcohol, and its derivative, Conjugated diene system polymer RATTEKUSU, such as maleic anhydride resin, a styrene butadiene copolymer, and a methyl methacrylate butadiene copolymer, Acrylic polymer RATTEKUSU, such as a polymer of acrylic ester and methacrylic acid ester, or a copolymer, Vinyl system polymer RATTEKUSU, such as an ethylene-vinylacetate copolymer, melamine resin, Thermoplastics, such as water borne adhesive of thermosetting resin, such as urea resin, polymethylmethacrylate, polyurethane resin, unsaturated polyester resin, a polyvinyl chloride acetate copolymer, a polyvinyl butyral, and an alkyd resin, etc. can be mentioned. A regular paper is acid paper or alkaline paper generally used, and coated paper is the coating paper which carried out coating of a binder, an inorganic pigment, the organic color, etc. If it records on an ink jet recording sheet processed by a water resistance improver for ink jet recording sheets of this invention by a water-based ink, a color in a water-based ink and cationic resin in an ink jet recording sheet will join together, elution of a color will be prevented, and it will be thought that a water resisting property improves. In cationic resin, a water resisting property can be improved by adjusting a hydrophobic section of an amine compound

which has two or more amino groups, and a hydrophilic part in a basic skeleton. As for a water-based ink to be used, it is preferred that it is what contains an anionic direct color or acid dye as a color, in addition contains a wetting agent, a color resolvent, an antiseptic, etc.

[0012]As an anionic direct color used for a water-based ink, For example, C. I.Direct. Black. 2, 4, 9, 11, 14, 17, 19, 22, 27, 32, 36, 38, 41, 48, 49, 51, 56, 62, 71, 74, 75, 77, 78, 80, 105, 106, 107, 108, 112, 113, 117, 132, 146, 154, 194, C. I.Direct Yellow 1, 2, 4, 8, 11, 12, 24, 25, 26, 27, 28, 33, 34, 39, 41, 42, 44, 48, 50, 51, 58, 72, 85, 86, 87, 88, 98, 100, and 110 and C.I.Direct. Orange. 3, 8, 10, 26, 29, 39, 41, 49, 51, 102, C.I.Direct Red1, 2, 4, 8, 9, 11, 13, 17, 18, 20, 23, 24, 28, 31, 33, 37, 39, 44, 46, 47, 48, 51, 59, 62, 63, 73, 75, 77, 80, 81, 83, 84, 85, 90, 94, 99, 101, 108, 110, 145, 189, 197, 220, 224, 225, 226, 227, 230, and C.I.Direct Violet 1, 7, and 9, 12, 35, 48, 51, 90, 94, and C.I.Direct. Blue. 1, 2, 6, 8, 15, 22, 25, 34, 69, 70, 71, 72, 75, 76, 78, 80, 81, 82, 83, 86, 90, 98, 106, 108, 110, 120, 123, 158, 163, 165, 192, 193, 194, 195, 196, 199, 200, 201, 202, 203, 207, 218, 236, 237, 239, 246, 258, C.I.Direct Green 1, 6, 8, 28, 33, 37, 63, and 64, and C.I.Direct Brown 1, 2, 6, 25, 27, 44, 58, and 95, 100, 101, 106, 112, 173, 194, 195, 209, 210, 211, etc. can be mentioned.

[0013]As acid dye, for example, C. I.Acid Black 1, 2, 7, 15, 17, 24, 26, 28, 31, 41, 48, 52, 60, 63, 94, 107, 109, 112, 118, 119, 121, 122, 131, 155, and 156 and C.I.Acid. Yellow. 1, 3, 4, 7, 11, 12, 13, 14, 17, 18, 19, 23, 25, 29, 34, 36, 38, 40, 41, 42, 44, 49, 53, 55, 59, 61, 71, 72, 76, 78, 99, 111, 114, 116, 122, 135, 161, 172, C. I.Acid. Orange. 7, 8, 10, 33, 56, 64, and C.I.Acid. Red. 1, 4, 6, 8, 13, 14, 15, 18, 19, 21, 26, 27, 30, 32, 34, 35, 37, 40, 42, 51, 52, 54, 57, 80, 82, 83, 85, 87, 88, 89, 92, 94, 97, 106, 108, 110, 115, 119, 129, 131, 133, 134, 135, 154, 155, 172, 176, 180, 184, 186, 187, 249, 254, 256, 317, 318, C.I.Acid Violet 7, 11, 15, 34, 35, 41, 43, 49, 75, and C.I.Acid Blue 1, 7, 9, 22, 23, 25, 27, 29, 40, 41, 43, 45, 49, 51, 53, 55, 56, 59, 62, 78, 80, 81, 83, 90, 92, 93, 102, and 104, 111, 113, 117, 120, 124, 126, 145, 167, 171, 175, 183, 229, 234, 236, C.I.Acid Green 3, 12, 19, 27, and 41, C.I.Acid Brown 4, 14, etc. can be mentioned. [0014]

[Example]Although an example is given to below and this invention is explained to it still in detail, this invention is not limited at all by these examples. In the example and the comparative example, evaluation of the water resistance improver for ink jet recording sheets was performed by the following method.

- (1) In 30 \*\*, it measured using the measurement Brookfield viscometer of viscosity.
- (2) Dilute the water resistance improver for production ink jet recording sheets of an ink jet recording sheet with water, and it is considered as the solution of 2.6 % of the weight of nonvolatile matters, The ink jet recording sheet coated with cationic resin  $0.5 \text{ g/m}^2$  is produced by using and carrying out  $19.2 \text{ g/m}^2$  coating of and the bar coating machine to the print sheet A of basis weight  $64 \text{ g/m}^2$  specified to JIS P 3101, and drying to it.



To a waterproof evaluation ink jet recording sheet, (3) Ink jet printer [Epson, Inc. After carrying out solid printing and neglecting black (Black), cyanogen (Cyan), magenta (Magenta), and each yellow (Yellow) monochrome for 1 hour using MJ-700V2C], it is immersed in a stream for 5 minutes, and change of a printed part is observed visually, and the following standard estimates.

O : a printed part is passed with water or does not spread.

\*\* : A printed part spreads a little.

x : A printed part is passed with water clearly and spreads.

(4) An ink jet printer [Epson, Inc. and MJ-700V2C] is used for the evaluation ink jet recording sheet of ink blot tightness, carry out dot printing of the black monochrome, observe a dot part using a magnifying glass 50 times the magnification of this, and the following standard estimates.

O : there is no blot.

\*\* : There is a blot a little.

x : There is a blot clearly.

[0015]30.0 g of ethylenediamine and the water 76.3g were taught to the 14 examples mouth flask, and 46.3 g of epichlorohydrin was dropped at it over 2 hours at 50 \*\*. It reacted at 70 \*\* after the end of dropping for 3 hours, the water 228.9g was added, and the water resistance improver for ink jet recording sheets which consists of cationic resin solution 20% of the weight was obtained. The viscosity of this 20-% of the weight cationic resin solution was 172 mPa-s. The ink jet recording sheet was produced using this water resistance improver for ink jet recording sheets, and evaluation of a water resisting property and ink blot tightness was performed. With black, cyanogen, magenta, and which [ yellow ] monochrome, the printed part was passed with water or did not spread, either. The blot was not observed in the dot part which carried out dot printing of the black monochrome.

51.5 g of diethylenetriamine and the water 97.8g were taught to the 24 examples mouth flask, and 46.3 g of epichlorohydrin was dropped at it over 2 hours at 50 \*\*. It reacted at 70 \*\* after the end of dropping for 3 hours, the water 293.4g was added, and the water resistance improver for ink jet recording sheets which consists of cationic resin solution 20% of the weight was obtained. The viscosity of this 20-% of the weight cationic resin solution was 260 mPa-s. The ink jet recording sheet was produced using this water resistance improver for ink jet recording sheets, and evaluation of a water resisting property and ink blot tightness was performed. With black, cyanogen, magenta, and which [ yellow ] monochrome, the printed part was passed with water or did not spread, either. The blot was not observed in the dot part which carried out dot printing of the black monochrome.

73.0 g of triethylenetetramine and the water 119.3g were taught to the 34 examples mouth flask, and 46.3 g of epichlorohydrin was dropped at it over 2 hours at 50 \*\*. It reacted at 70 \*\*

after the end of dropping for 3 hours, the water 357.9g was added, and the water resistance improver for ink jet recording sheets which consists of cationic resin solution 20% of the weight was obtained. The viscosity of this 20-% of the weight cationic resin solution was 337 mPa-s. The ink jet recording sheet was produced using this water resistance improver for ink jet recording sheets, and evaluation of a water resisting property and ink blot tightness was performed. With black, cyanogen, magenta, and which [ yellow ] monochrome, the printed part was passed with water or did not spread, either. The blot was not observed in the dot part which carried out dot printing of the black monochrome.

94.5 g of tetraethylenepentamine and the water 140.8g were taught to the 44 examples mouth flask, and 46.3 g of epichlorohydrin was dropped at it over 2 hours at 50 \*\*. It reacted at 70 \*\* after the end of dropping for 3 hours, the water 422.4g was added, and the water resistance improver for ink jet recording sheets which consists of cationic resin solution 20% of the weight was obtained. The viscosity of this 20-% of the weight cationic resin solution was 391 mPa-s. The ink jet recording sheet was produced using this water resistance improver for ink jet recording sheets, and evaluation of a water resisting property and ink blot tightness was performed. With black, cyanogen, magenta, and which [ yellow ] monochrome, the printed part was passed with water or did not spread, either. The blot was not observed in the dot part which carried out dot printing of the black monochrome.

[0016]37.0 g of propylenediamine and the water 83.3g were taught to the 54 examples mouth flask, and 46.3 g of epichlorohydrin was dropped at it over 2 hours at 50 \*\*. It reacted at 70 \*\* after the end of dropping for 3 hours, the water 249.9g was added, and the water resistance improver for ink jet recording sheets which consists of cationic resin solution 20% of the weight was obtained. The viscosity of this 20-% of the weight cationic resin solution was 228 mPa-s. The ink jet recording sheet was produced using this water resistance improver for ink jet recording sheets, and evaluation of a water resisting property and ink blot tightness was performed. With black, cyanogen, magenta, and which [ yellow ] monochrome, the printed part was passed with water or did not spread, either. The blot was not observed in the dot part which carried out dot printing of the black monochrome.

58.0 g of N,N,N',N'-tetramethylethylenediamine and the water 104.3g were taught to the 64 examples mouth flask, and 46.3 g of epichlorohydrin was dropped at it over 2 hours at 50 \*\*. It reacted at 70 \*\* after the end of dropping for 3 hours, the water 312.9g was added, and the water resistance improver for ink jet recording sheets which consists of cationic resin solution 20% of the weight was obtained. The viscosity of this 20-% of the weight cationic resin solution was 290 mPa-s. The ink jet recording sheet was produced using this water resistance improver for ink jet recording sheets, and evaluation of a water resisting property and ink blot tightness was performed. With black, cyanogen, magenta, and which [ yellow ] monochrome, the printed part was passed with water or did not spread, either. The blot was not observed in the dot part

which carried out dot printing of the black monochrome.

65.0 g of N,N,N',N'-tetramethyl propylenediamine and the water 111.3g were taught to the 74 examples mouth flask, and 46.3 g of epichlorohydrin was dropped at it over 2 hours at 50 \*\*. It reacted at 70 \*\* after the end of dropping for 3 hours, the water 333.9g was added, and the water resistance improver for ink jet recording sheets which consists of cationic resin solution 20% of the weight was obtained. The viscosity of this 20-% of the weight cationic resin solution was 360 mPa-s. The ink jet recording sheet was produced using this water resistance improver for ink jet recording sheets, and evaluation of a water resisting property and ink blot tightness was performed. With black, cyanogen, magenta, and which [ yellow ] monochrome, the printed part was passed with water or did not spread, either. The blot was not observed in the dot part which carried out dot printing of the black monochrome.

15.0 g of ethylenediamine, 36.5g of triethylenetetramine, and the water 97.8g were taught to the 84 examples mouth flask, and 46.3 g of epichlorohydrin was dropped at it over 2 hours at 50 \*\*. It reacted at 70 \*\* after the end of dropping for 3 hours, the water 293.4g was added, and the water resistance improver for ink jet recording sheets which consists of cationic resin solution 20% of the weight was obtained. The viscosity of this 20-% of the weight cationic resin solution was 282 mPa-s. The ink jet recording sheet was produced using this water resistance improver for ink jet recording sheets, and evaluation of a water resisting property and ink blot tightness was performed. With black, cyanogen, magenta, and which [ yellow ] monochrome, the printed part was passed with water or did not spread, either. The blot was not observed in the dot part which carried out dot printing of the black monochrome.

[0017]15.0 g of ethylenediamine, 29.0g of N,N,N',N'-tetramethylethylenediamine, and the water 90.3g were taught to the 94 examples mouth flask, and 46.3 g of epichlorohydrin was dropped at it over 2 hours at 50 \*\*. It reacted at 70 \*\* after the end of dropping for 3 hours, the water 270.9g was added, and the water resistance improver for ink jet recording sheets which consists of cationic resin solution 20% of the weight was obtained. The viscosity of this 20-% of the weight cationic resin solution was 241 mPa-s. The ink jet recording sheet was produced using this water resistance improver for ink jet recording sheets, and evaluation of a water resisting property and ink blot tightness was performed. With black, cyanogen, magenta, and which [ yellow ] monochrome, the printed part was passed with water or did not spread, either. The blot was not observed in the dot part which carried out dot printing of the black monochrome.

29.0 g of N,N,N',N'-tetramethylethylenediamine, 32.5g of N,N,N',N'-tetramethyl propylenediamine, and the water 107.8g were taught to the 104 examples mouth flask, and 46.3 g of epichlorohydrin was dropped at it over 2 hours at 50 \*\*. It reacted at 70 \*\* after the end of dropping for 3 hours, the water 323.4g was added, and the water resistance improver for ink jet recording sheets which consists of cationic resin solution 20% of the weight was

obtained. The viscosity of this 20-% of the weight cationic resin solution was 284 mPa-s. The ink jet recording sheet was produced using this water resistance improver for ink jet recording sheets, and evaluation of a water resisting property and ink blot tightness was performed. With black, cyanogen, magenta, and which [ yellow ] monochrome, the printed part was passed with water or did not spread, either. The blot was not observed in the dot part which carried out dot printing of the black monochrome.

15.0 g of ethylenediamine and the water 90.3g were taught to the 114 examples mouth flask, and 23.2 g of epichlorohydrin was dropped at it over 2 hours at 50 \*\*. It reacted at 70 \*\* after the end of dropping for 2 hours. Subsequently, the reaction mixture was cooled at 50 \*\*, 29.0 g of N,N,N',N'-tetramethylethylenediamine was added, and 23.2 g of epichlorohydrin was dropped over 2 hours at 50 \*\*. It reacted at 70 \*\* after the end of dropping for 2 hours, the water 270.9g was added, and the water resistance improver for ink jet recording sheets which consists of cationic resin solution 20% of the weight was obtained. The viscosity of this 20-% of the weight cationic resin solution was 211 mPa-s. The ink jet recording sheet was produced using this water resistance improver for ink jet recording sheets, and evaluation of a water resisting property and ink blot tightness was performed. With black, cyanogen, magenta, and which [ yellow ] monochrome, the printed part was passed with water or did not spread, either. The blot was not observed in the dot part which carried out dot printing of the black monochrome.

[0018]36.0 g of ethylenediamine and the water 73.0g were taught to the 124 examples mouth flask, and 37.0 g of epichlorohydrin was dropped at it over 2 hours at 50 \*\*. It reacted at 70 \*\* after the end of dropping for 3 hours, the water 219.0g was added, and the water resistance improver for ink jet recording sheets which consists of cationic resin solution 20% of the weight was obtained. The viscosity of this 20-% of the weight cationic resin solution was 73 mPa-s. The ink jet recording sheet was produced using this water resistance improver for ink jet recording sheets, and evaluation of a water resisting property and ink blot tightness was performed. With black, cyanogen, magenta, and which [ yellow ] monochrome, the printed part was passed with water or did not spread, either. The blot was not observed in the dot part which carried out dot printing of the black monochrome.

69.6 g of N,N,N',N'-tetramethylethylenediamine and the water 106.6g were taught to the 134 examples mouth flask, and 37.0 g of epichlorohydrin was dropped at it over 2 hours at 50 \*\*. It reacted at 70 \*\* after the end of dropping for 3 hours, the water 319.8g was added, and the water resistance improver for ink jet recording sheets which consists of cationic resin solution 20% of the weight was obtained. The viscosity of this 20-% of the weight cationic resin solution was 86 mPa-s. The ink jet recording sheet was produced using this water resistance improver for ink jet recording sheets, and evaluation of a water resisting property and ink blot tightness was performed. With black, cyanogen, magenta, and which [ yellow ] monochrome, the printed part

was passed with water or did not spread, either. The blot was not observed in the dot part which carried out dot printing of the black monochrome.

46.4 g of N,N,N',N'-tetramethylethylenediamine and the water 101.9g were taught to the 144 examples mouth flask, and 55.5 g of epichlorohydrin was dropped at it over 2 hours at 50 \*\*. It reacted at 70 \*\* after the end of dropping for 3 hours, the water 305.7g was added, and the water resistance improver for ink jet recording sheets which consists of cationic resin solution 20% of the weight was obtained. The viscosity of this 20-% of the weight cationic resin solution was 84 mPa-s. The ink jet recording sheet was produced using this water resistance improver for ink jet recording sheets, and evaluation of a water resisting property and ink blot tightness was performed. With black, cyanogen, magenta, and which [ yellow ] monochrome, the printed part was passed with water or did not spread, either. The blot was not observed in the dot part which carried out dot printing of the black monochrome.

63.8 g of N,N,N',N'-tetramethylethylenediamine and the water 110.1g were taught to the 154 examples mouth flask, and 46.3 g of epichlorohydrin was dropped at it over 2 hours at 50 \*\*. It reacted at 70 \*\* after the end of dropping for 3 hours, the water 330.3g was added, pH was adjusted to five using sulfuric acid, and the water resistance improver for ink jet recording sheets which consists of cationic resin solution 20% of the weight was obtained. The viscosity of this 20-% of the weight cationic resin solution was 126 mPa-s. The ink jet recording sheet was produced using this water resistance improver for ink jet recording sheets, and evaluation of a water resisting property and ink blot tightness was performed. With black, cyanogen, magenta, and which [ yellow ] monochrome, the printed part was passed with water or did not spread, either. The blot was not observed in the dot part which carried out dot printing of the black monochrome.

[0019] Instead of the sulfuric acid used in example 16 Example 15, the water resistance improver for ink jet recording sheets which consists of cationic resin solution 20% of the weight was obtained like Example 15 except having used acetic acid. The viscosity of this 20-% of the weight cationic resin solution was 130 mPa-s. The ink jet recording sheet was produced using this water resistance improver for ink jet recording sheets, and evaluation of a water resisting property and ink blot tightness was performed. With black, cyanogen, magenta, and which [ yellow ] monochrome, the printed part was passed with water or did not spread, either. The blot was not observed in the dot part which carried out dot printing of the black monochrome. 63.8 g of N,N,N',N'-tetramethylethylenediamine and the water 116.4g were taught to the 174 examples mouth flask, and 46.3 g of epichlorohydrin was dropped at it over 2 hours at 50 \*\*. It reacted at 70 \*\* after the end of dropping for 3 hours, and 6.3 g of benzyl chlorides were further dropped over 1 hour at 70 \*\* after ending reaction. It reacted at 70 \*\* after the end of dropping for 3 hours, the water 349.2g was added, and the water resistance improver for ink jet recording sheets which consists of cationic resin solution 20% of the weight was obtained.

The viscosity of this 20-% of the weight cationic resin solution was 130 mPa-s. The ink jet recording sheet was produced using this water resistance improver for ink jet recording sheets, and evaluation of a water resisting property and ink blot tightness was performed. With black, cyanogen, magenta, and which [ yellow ] monochrome, the printed part was passed with water or did not spread, either. The blot was not observed in the dot part which carried out dot printing of the black monochrome.

The 20-% of the weight cationic resin solution of example 18 Example 1 and the 20-% of the weight cationic resin solution of Example 6 were mixed by the weight ratio 1:1, and the water resistance improver for ink jet recording sheets was obtained. The viscosity of this 20-% of the weight cationic resin solution was 228 mPa-s. The ink jet recording sheet was produced using this water resistance improver for ink jet recording sheets, and evaluation of a water resisting property and ink blot tightness was performed. With black, cyanogen, magenta, and which [ yellow ] monochrome, the printed part was passed with water or did not spread, either. The blot was not observed in the dot part which carried out dot printing of the black monochrome.

[0020]The 50-% of the weight solution 90.0g and the water 92.5g of dimethylamine were taught to the 14 comparative example mouth flask, and 92.5 g of epichlorohydrin was dropped at it over 1 hour at 30 \*\*. It reacted at 80 \*\* after the end of dropping for 5 hours, the water 412.5g was added, and the water resistance improver for ink jet recording sheets which consists of cationic resin solution 20% of the weight was obtained. The ink jet recording sheet was produced using this water resistance improver for ink jet recording sheets, and evaluation of a water resisting property and ink blot tightness was performed. Although the printed part was passed with water or did not spread about black and the monochrome of magenta, about cyanogen and yellow monochrome, the printed part was blurred a little. The blot was observed a little in the dot part which carried out dot printing of the black monochrome.

Instead of the cationic resin which has the structure expressed with comparative example 2 general formula [1], polyethyleneimine (molecular weight 1,200) was used, the ink jet recording sheet was produced, and evaluation of a water resisting property and ink blot tightness was performed. About black and the monochrome of magenta, the printed part spread a little, and about cyanogen and yellow monochrome, the printed part was passed with water clearly and blurred. The blot was clearly observed in the dot part which carried out dot printing of the black monochrome. The evaluation result of a raw material presentation and water resisting property of Examples 1-18 and the comparative examples 1-2, and ink blot tightness is shown in the 1st table.

[0021]

[Table 1]

第1表-1

		実施例1	実施例2	実施例3	実施例4	実施例5	実施例6	実施例7
原料組成 (g)	エチレンジアミン	30.0	—	—	—	—	—	—
	ジエチレントリアミン	—	51.5	—	—	—	—	—
	トリエチレンテトラミン	—	—	73.0	—	—	—	—
	テトラエチレンペンタミン	—	—	—	94.5	—	—	—
	プロピレンジアミン	—	—	—	—	37.0	—	—
	N,N,N',N'-テトラメチル エチレンジアミン	—	—	—	—	—	58.0	—
	N,N,N',N'-テトラメチル プロピレンジアミン	—	—	—	—	—	—	65.0
	エピクロロヒドリン	46.3	46.3	46.3	46.3	46.3	46.3	46.3
	硫酸	—	—	—	—	—	—	—
	酢酸	—	—	—	—	—	—	—
	塩化ベンジル	—	—	—	—	—	—	—
	粘度 (mPa・s)	172	260	337	391	228	290	360
耐水性	黒色	○	○	○	○	○	○	○
	シアン	○	○	○	○	○	○	○
	マゼンタ	○	○	○	○	○	○	○
	黄色	○	○	○	○	○	○	○
インク滲み防止性		○	○	○	○	○	○	○

[0022]

[Table 2]

第1表-2

		実施例8	実施例9	実施例10	実施例11	実施例12
原料組成 (g)	エチレンジアミン	15.0	15.0	—	15.0	36.0
	ジエチレントリアミン	—	—	—	—	—
	トリエチレンテトラミン	36.5	—	—	—	—
	テトラエチレンペンタミン	—	—	—	—	—
	プロピレンジアミン	—	—	—	—	—
	N,N,N',N'-テトラメチル エチレンジアミン	—	29.0	29.0	29.0	—
	N,N,N',N'-テトラメチル プロピレンジアミン	—	—	32.5	—	—
	エピクロロヒドリン	46.3	46.3	46.3	23.2+23.2	37.0
	硫酸	—	—	—	—	—
	酢酸	—	—	—	—	—
	塩化ベンジル	—	—	—	—	—
	粘度 (mPa・s)	282	241	284	211	73
耐水性	黒色	○	○	○	○	○
	シアン	○	○	○	○	○
	マゼンタ	○	○	○	○	○
	黄色	○	○	○	○	○
インク滲み防止性		○	○	○	○	○

[0023]

[Table 3]

第1表-3

		実施例13	実施例14	実施例15	実施例16	実施例17
原料組成 (g)	エチレンジアミン	—	—	—	—	—
	ジチエントリアミン	—	—	—	—	—
	トリエチレンテトラミン	—	—	—	—	—
	テトラエチレンペンタミン	—	—	—	—	—
	プロピレンジアミン	—	—	—	—	—
	N,N,N',N'-テトラメチルエチレンジアミン	69.6	46.4	63.8	63.8	63.8
	N,N,N',N'-テトラメチルプロピレンジアミン	—	—	—	—	—
	エピクロロヒドリン	37.0	55.5	46.3	46.3	46.3
	硫酸	—	—	(pH=5)	—	—
	酢酸	—	—	—	(pH=5)	—
	塩化ベンジル	—	—	—	—	6.3
粘度 (mPa・s)		86	84	126	130	130
耐水性	黒色	○	○	○	○	○
	シアン	○	○	○	○	○
	マゼンタ	○	○	○	○	○
	黄色	○	○	○	○	○
インク滲み防止性		○	○	○	○	○

[0024]

[Table 4]

第1表-4

		実施例18	比較例1	比較例2
原料組成 (g)	ジメチルアミン	実施例1の カチオン性樹脂と 実施例6の カチオン性樹脂の 1:1混合物	45.0	ポリエチレン イミン
	エチレンジアミン		—	
	ジエチレントリアミン		—	
	トリエチレンテトラミン		—	
	テトラエチレンペンタミン		—	
	プロピレンジアミン		—	
	N,N,N',N'-テトラメチルエチレンジアミン		—	
	N,N,N',N'-テトラメチルプロピレンジアミン		—	
	エピクロロヒドリン		92.5	
	硫酸		—	
	酢酸		—	
	塩化ベンジル		—	
粘度 (mPa・s)		228	—	—
耐水性	黒色	○	○	△
	シアン	○	△	×
	マゼンタ	○	○	△
	黄色	○	△	×
インク滲み防止性		○	△	×

[0025]The ink jet recording sheet which coated and produced the water resistance improver for



ink jet recording sheets of this invention of Examples 1-18 has the water resisting property outstanding also to which ink, and is excellent also in ink blot tightness so that clearly from the result of the 1st table. On the other hand, the ink jet recording sheet of the comparative example 1 produced using the cationic resin compounded from dimethylamine and epichlorohydrin, It is a little inferior to a water resisting property and ink blot tightness, and the ink jet recording sheet of the comparative example 2 produced using the polyethyleneimine currently conventionally used as a water resistance improver for ink jet recording sheets is further inferior to a water resisting property and ink blot tightness.

[0026]

[Effect of the Invention]By coating the water resistance improver for ink jet recording sheets of this invention, the water resisting property of the picture recorded using an ink jet printer or a character can be raised, and the ink jet recording sheet which can record the image of the outstanding image quality without an ink blot can be obtained.

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[Translation done.]